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DISINFECTION BY ANTISEPTICS IN MANAGEMENT OF POSTOPERATIVE SURGICAL WOUNDS IN UROLOGIC OPERATIONS

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The objective of this study was to confirm that frequent disinfection by antiseptics is unnecessary on surgical wounds of urologic operations. Patients who received urologic operations were divided into 3 groups that had the same surgical dressings but different frequencies of disinfection and different antiseptics used. Surgical wounds were evaluated clinically and bacteriologically for the period until removal of sutures. Of the 97 patients randomly recruited for the study, 3 developed surgical-site infection (SSI). There was no significant difference in the incidence of SSI among the 3 groups. Bacterial counts of surgical wounds increased over time after operation, to similar extents in the 3 groups. The major isolate was *Staphylococcus epidermidis*, one of the normal florae on the skin. This strain was found at almost equal frequencies in all groups. In conclusion, our study suggested that covering with the surgical dressing without frequent disinfection by antiseptics was effective for prevention of SSI. Thus, traditional frequent disinfection should be abandoned.

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Key words : Disinfection, Antisepsis, Surgical wound, Urologic surgery, Surgical site infection

INTRODUCTION

Better management of surgical wounds is the first step for preventing surgical-site infection (SSI), which may sometimes cause serious hospital-acquired infection in surgical wards. The Hospital Infection Control Practices Advisory Committee[1)] has established a guideline for prevention of SSI, and recommended various practical methods for its prevention. Unfortunately, the guideline is not directly applied to SSI of urologic surgery. Indeed, only a few studies on SSI of urological operations were cited in the guideline. Thus, urologists should reevaluate the guideline for its applicability to postoperative management of wounds of urological operations.

While postoperative antiseptics have traditionally been used for prevention of SSI, recent studies have cast doubt on their efficacy. One report suggested that it sometimes produced toxic effects on tissues so that wound healing might be delayed[2)] In addition, new materials for dressing the surgical wound have been developed and are used in the clinical setting[3)] The guideline recommended a postoperative sterile dressing on the surgical wound for 24 to 48 hours. Its rationale was supported by several studies[1)] We empirically understand that a sterile dressing is clinically effective in management of the surgical wound. However, there is insufficient evidence or no consensus on whether its efficacy lasts beyond 48 hours[1)]. In addition, no reports have referred to the clinical efficacy of concomitant use of antiseptics. Therefore, we conducted a prospective, comparative study to determine whether disinfection is needed for prevention of SSI in urological surgery.

PATIENTS AND METHODS

Patients ;

The study included 97 patients who underwent open urological surgery at Sapporo Medical University Hospital and Hokkaido Health Insurance Hospital from September 2000 to February 2001. The operations consisted of radical nephrectomy, hand-assisted laparoscopic radical nephrectomy, partial nephrectomy, radical cystectomy with ileal conduit or ileal neobladder, radical prostatectomy, suprapubic prostatectomy, pyeloplasty, resection of retroperitoneal tumor, and radical orchiectomy. We excluded from the study patients who were revealed to have postoperative deep or organ infection, for which more aggressive management than a simple dressing was needed.

Methods ;

1) Preparation of surgical site before and after operation.

Hair clipping was performed on the surgical site of lower abdomen of the patients the day before the operation. The surgical site was prepared using 10% povidone iodine before incision in all patients and the operation was aseptically done in a standard manner. The surgical wound was aseptically closed with metal

clips. After operation, patients were prospectively and randomly assigned into 3 groups that had different use of antiseptics. The groups consisted of those with povidone iodine (PI), povidone iodine and normal saline (PI-NS) and only normal saline (NS). In the round, we randomly assigned into 2 groups, PI and PI-NS in September 2000. Then, we randomly assigned into 3 groups since October 2000. The study was done using the table of random numbers. Immediately after closure of the wound, the surgical site was disinfected with a 10% povidone iodine solution-containing cotton ball in the PI and PI-NS groups or normal saline in the NS group. Then the site was dried spontaneously and covered with the dressing material, OpSite wound 〈postop〉 (Smith & Nephew KK, Tokyo, Japan). On postoperative day (POD)-2, the dressing material was removed, and the surgical site was disinfected with a 10% povidone iodine solution-containing cotton ball in the PI group or with normal saline in the PI-NS and NS groups, and then the site was covered with the same dressing material again. The material was kept on the site, and on POD-7, the dressing was removed and the site was disinfected using the same method as on POD-2 in each group. The suture was finally removed at POD-7. This clinical trial started slightly later in the NS group than in the other 2 groups. We generally used a closed drainage system in open surgeries, except in case of radical orchiectomy in which a penrose drain was used. Drains were usually removed within 2 to 3 days postoperation. The time of removal of the drains was not dependent on that of the exchange of the dressing material.

2) Surgical wound classification and evaluation of SSI.

The surgical wound was classified according to the definition advocated by the Centers for Disease Control and Prevention[4] and previous reports[5,6] In this study, we classified the surgical wounds as below. "Clean operations" consisted of radical nephrectomy, hand-assisted radical nephrectomy, and partial nephrectomy, all of which had no concomitant urinary tract infection (UTI). Radical orchiectomy was included in this group. "Clean-contaminated operations" consisted of radical prostatectomy, pyeloplasty, and suprapubic prostatectomy, in which all surgical sites were exposed to urine but not associated with UTI. "Contaminated operations" consisted of radical cystectomy with ileal conduit or ileal neobladder. In addition, when the surgical sites of operations had a possibility to be exposed for urine in patients having UTI, they were classified into the group of "contaminated operations"

3) Antimicrobial prophylaxis.

Antimicrobial agents were used for prophylaxis of SSI according to the type of operation. Randomly selected antimicrobial agents from penicillin, or the first or second generation of cephalosporins were intravenously given 30 minutes before surgery. When the operation was prolonged more than 3 hours, the same antimicrobial agent was given again. Postoperative administration of the antimicrobial agent was done until POD-3 for radical cystectomy and until POD-2 for radical prostatectomy. No additional administration of the agent except for that given before surgery was basically done in the other operations. If the patients had preoperative UTI, they received optimal antimicrobial chemotherapy for 3 to 5 days before operation.

4) Bacteriological study.

Bacteriological examination was done three times, just after operation, at the time of exchange of the dressing material on POD-2 and at removal of the suture on POD-7. Each examination was done before disinfection of the surgical wound. The skin area around 1 cm from the suture was carefully wiped with a sterile moist cotton bar and its head was spread on a blood agar plate according to the method described by Bjornson[7] In this method, the primary, secondary and tertiary streak areas were used for objective grading of the bacterial density on the streaked plate. The plates were incubated at 37°C for 24 hours and colonies were examined for bacterial strains using API Identification System series (bioMérieux, Marcy I'Etoile, France). Bacterial quantification was done according to the method of Bjornson[7] Statistical analysis was done using the chi-square test, Kruskal-Wallis test and Spearman rank correlation coefficient.

5) Others

Our study was not approved by the IRB in our university and we did not obtain written informed consent from participants.

RESULTS

There were no significant differences in sex, mean age or length of the surgical wound among the 3 groups

Table 1. Demographics of 97 patients according to groups categorized by disinfection method for surgical wound

	PI group	PI-NS group	NS group	p-value
No. of patients	38	34	25	
Sex (male/female)	30/8	28/6	21/4	0.87[1)]
Mean age (S.D.)	62.5 (12.0)	58.2 (12.2)	61.3 (11.8)	0.21[2)]
Mean wound length (S.D.) cm	17.2 (12.0)	18.3 (12.0)	17.0 (12.0)	0.97[2)]

PI: povidone iodine, NS: normal saline, S.D.: standard deviation, [1)] chi-square test, [2)] Kruskal-Wallis test.

Table 2. Number of patients according to mode of operation and groups categorized by disinfection method for surgical wound

Operations	PI group	PI-NS group	NS group
Radical Nx (open or HALS)	12 (32%)	14 (41%)	10 (40%)
Partial Nx	1 (3%)	4 (12%)	0
Pyeloplasty	2 (5%)	0	0
Resection of tumor[1)]	1 (2%)	0	0
Radical Cx[2)]	5 (13%)	4 (12%)	5 (20%)
Radical Px	12 (32%)	11 (32%)	9 (36%)
Surapubic Px	3 (8%)	0	0
Radical Ox	2 (5%)	1 (3%)	1 (4%)
Total	38	34	25

Nx: nephrectomy, Cx: cystectomy, Px: prostatectomy, Ox: orchiectomy, HALS: hand-assisted laparoscopic surgery, [1)]: resection of retroperitoneal tumor, [2)]: with ileal conduit or ileal neobladder, PI and NS: same as in Table 1.

(Table 1). Thus, no difference was found in the area of the dressing among the 3 groups. Although there was a small difference in proportions of operation modes, similar operations were done in each group (Table 2). Distribution of surgical wound classification did not differ among the 3 groups ($p=0.65$, chi-square test) (Table 3). Superficial SSI was found in 2 patients of the PI group and one of the NS groups. There was no significant difference in the rate of SSI among the 3 groups ($p=0.42$, chi-square test). In one patient in the PI group who developed SSI after radical cystectomy with ileal conduit, methicillin-resistant *Staphylococcus aureus* (MRSA) was isolated from the wound. He had had UTI caused by the same organism before the operation and was regarded as having "contaminated" status. In another patient, who received radical cystectomy, with SSI in the PI group, *Staphylococcus epidermidis* was isolated from the wound. The third patient, who received radical orchiectomy in the NS group, had SSI caused by *Corynebacterium* species, *Klebisiella pneumoniae* and *Escherichia coli*. In these 3 patients with SSI, we found each SSI at the time of uncovering POD-7. There was no clear relationship between wound dehiscence and the surgical wound classification among the 3 groups. No patients had allergic reactions on their surgical sites.

Table 3. Distribution of the surgical wound classification according to group categorized by disinfection method for surgical wound

Surgical wound classification	PI-group	PI-NS group	NS group
Clean	11 (29%)	14 (41%)	9 (36%)
Clean-contaminated	22 (58%)	14 (41%)	11 (44%)
Contaminated	5 (13%)	6 (18%)	5 (20%)

Clean, clean-contaminated or contaminated: definition by the Centers for Disease Control and Prevention[4)] PI and NS: same as in Table 1.

In the study of bacterial quantification of surgical wound, the number of patients who harbored more bacterial colonies increased significantly or nearly significantly over time after operation in each group (Table 4). However, the extent of bacterial growth over time did not differ significantly among the 3 groups.

The bacterium most frequently isolated from surgical wounds was *Staphylococcus epidermidis*, followed by *Staphylococcus capitis* and *Staphylococcus caprae* (Table 5), which were almost equally found among the 3 groups. There were extremely small number of isolated bacterial species except top two bacterial species in this study.

DISCUSSION

Even in the era of minimally invasive surgery, which achieves a shorter operation time and hospital stay period, SSI is still a major concern for surgeons. Indeed, we sometimes encounter patients who develop SSI caused by antimicrobial-resistant microorganisms, which may frustrate both patients and surgeons. The Hospital Infection Control Practices Advisory Committee announced a guideline for prevention of SSI[1)] Unfortunately, it does not refer to the issue of several major urologic operations, as we wrote earlier. Thus, in this study, we tried to determine the bacterial backgrounds of surgical wounds and incidence of SSI, so

Table 4. Bacterial quantification on the surgical wounds of the 3 groups

	PI group					PI-NS group					NS group				
	No. of pts. by quantification					No. of pts. by quantification					No. of pts. by quantification				
Bacterial quantification	0	+1	+2	+3	+4	0	+1	+2	+3	+4	0	+1	+2	+3	+4
POD-1	27	5	1	1	4	25	2	0	4	3	12	7	0	1	5
POD-2	19	4	1	4	10	24	3	0	0	7	14	6	0	0	5
POD-7	18	2	1	2	15	18	3	0	0	13	7	5	1	1	11

Correlation between postoperative day and bacterial quantification in each group by Spearman rank correlation coefficient: $p=0.009$ in PI, $p=0.034$ in PI-NS, and $p=0.06$ in NS groups. Difference in distribution of patients according to bacterial quantification among the 3 groups by Kruskal-Wallis test: $p=0.083$. POD: postoperative day. Bacterial quantification (see reference 7 for more details): "0": no colonies in the primary, secondary and tertiary streak areas. "+1": 5-10 colonies in the primary, <5 in the secondary and no colonies in the tertiary areas. "+2": >10 colonies in the primary, <5 in the secondary and no colonies in the tertiary areas. "+3": >10 colonies in the primary, >5 in the secondary and <5 in the tertiary areas. "+4": >10 colonies in the primary, >5 in the secondary and >5 in the tertiary areas.

Table 5. The percentage in the top two bacterial species isolated from surgical wounds

	PI group	PI-NS group	NS group
POD-0	S. epidermidis (30%)	S. epidermidis (50%)	S. epidermidis (47%)
	S. capitis (20%)	S. capitis (30%)	S. capitis (20%)
POD-2	S. epidermidis (56%)	S. epidermidis (33%)	S. epidermidis (36%)
	S. capitis (12%)	S. capitis (22%)	S. capitis (18%)
POD-7	S. epidermidis (47%)	S. epidermidis (35%)	S. epidermidis (25%)
	S. capitis (10%)	S. caprae (13%)	S. caprae (21%)

(%): % of bacterial strains isolated for each postoperative day and group.

that we could provide better care of surgical wounds in patients who receive various open or laparoscopic urologic operations.

Disinfection by antiseptics has been used for management of surgical wounds. This is because antiseptics having broad-spectrum activities against many microorganisms are believed to be beneficial for prevention of SSI. However, they also have the potential to damage to some extent healing of the surgical wound[2]. Thus, their use should be restricted to a limited area. In this study, there was no significant difference in the incidence of SSI among the 3 groups in which different methods were used for disinfection in management of wounds. In addition, the 3 groups had almost same counts of bacterial colonies isolated from surgical wounds over time after operation and almost the same bacterial strains were identified. The frequently isolated bacterial strains were *Staphylococcus epidermidis* and other staphylococcus species, which were those normally isolated on the skin. These results indicate that frequent disinfection by antiseptics of the surgical wound after operation is not necessary for preventing SSI, particularly, when the wound is stable upon careful observation. Rather, frequent use of antiseptics may increase the number of patients who develop contact dermatitis[8].

In recent years, surgical dressings have improved and been used not only in management of surgical wounds but for catheter indwelling sites[3] In management of surgical wounds, the guideline recommended that sterile dressing of the wound for 24 to 48 hours postoperatively and its clinical relevance was supported by some studies[1] We empirically understand that sterile dressing is effective for keeping a surgical wound uninfected. However, because of a lack of sufficient evidence for management of wounds beyond 48 hours[1], we conducted the current study. In this study, we were able to show that the postoperative surgical dressing, even without frequent disinfection by antiseptics, was effective for keeping the surgical wound uninfected. Indeed, since major bacterial strains isolated from wounds were normal florae of the skin, surgical dressing alone was adequate for management of wounds. Careful observation may be more important for urologists to keep the wound uninfected than frequent unnecessary disinfection by antiseptics.

The primary causative organisms of SSI are *Staphylococcus aureus* (mostly MRSA in hospital), *Pseudomonas aeruginosa* and beta-hemolytic streptococci[9] They are commonly transmitted by via the hands of medical members. They are sometimes multiple antimicrobial-resistant bacteria that are usually refractory to treatment. Hand-washing is the principal countermeasure against the transmission of these organisms. In addition, surgical dressing alone without frequent disinfection may prevent wound contamination due to unnecessary wound management of the medical staff.

In conclusion, surgical dressing without frequent disinfection by antiseptics may be the most appropriate method to keep postoperative wounds uninfected. Traditional frequent disinfection by antiseptics should be abandoned in management of surgical wounds in urologic operations.

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和文抄録

泌尿器科手術における術創の消毒の意義

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現在，術創部の頻回の消毒は一般的ではないが，その細菌学的意義についての検討は少ない．本研究の目的は，泌尿器科手術の術創に対する頻回の消毒は不要であることを細菌学的に明らかにすることである．われわれは，泌尿器科での手術を受けた症例を，創部の消毒を行った群，消毒を行わなかった群，術直後のみ行った群で，創処置別に3群に分けた．術創部の評価は臨床的かつ細菌学的に抜糸の日まで行った．全97例を3群に分けて検討したが，3例で創部感染を認めた．3群間での創部感染に関する有意差はなかった．創部の細菌数は術後の時間がたつごとに増加したが，3群で同じ傾向であった．分離菌では，皮膚の常在菌の一種である表皮ブドウ球菌が最も多く，3群間でもほぼ同様の頻度であった．したがって，術後の創部の処置として，汚染手術などの特殊な場合を除いて，消毒しないで被覆しておくことは有効であり，頻回の消毒は意味がないと考えられた．

（泌尿紀要 **52**：89-94，2006）